

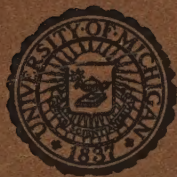
MICHIGAN BUSINESS STUDIES

VOL. I, NO. 2

JANUARY, 1927

AN INDEX OF LOCAL REAL ESTATE PRICES

BY
HERMAN WYNGARDEN



UNIVERSITY OF MICHIGAN
SCHOOL OF BUSINESS ADMINISTRATION
BUREAU OF BUSINESS RESEARCH
ANN ARBOR
1927

A dissertation submitted in partial fulfillment
of the requirements for the degree of Doctor
of Philosophy in the University of Michigan.

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FOREWORD

The question of value lies at the heart of a large number of real estate problems. It confronts the owner who wants to sell and the prospective purchaser about to buy. It faces the real estate dealer constantly, whether he is trying to secure a listing, close a transaction, or give advice to a client. Successful investment in real estate depends upon the ability to analyze values properly, and unsuccessful investment usually arises from failure to understand the forces that make value and those that destroy it. It would, therefore, be difficult to exaggerate the importance of the constant study of the various aspects of real estate value.

Real estate value finds expression in a number of ways. First of all, it manifests itself in the consideration involved in a transaction. Actual considerations are frequently considered as the only true criteria of value. This point of view, however, seems to over-emphasize the accuracy of selling prices as indicia of value; it may be noted frequently that real estate will sell for less than it is obviously "worth," and many a purchaser has bought real estate at a price which afterward seemed too high. In a perfectly normal market, selling prices would represent actual value; but few real estate transactions are made in which normal market conditions are present. Sales prices, therefore, must be considered as but one of the manifestations of value.

Another evidence of value is found in the prices asked for real estate by its owners. These prices represent the owners' estimates of value. Since they come from prejudiced parties, they cannot be given too great weight; but they may rightfully be used.

Likewise, bona fide offers, whether they result in sales or not, represent buyers' estimates of value and may be considered as criteria of value. Since a prospective purchaser wants to buy at as low a figure as possible, offered prices must also be utilized with care.

Another basis for estimating the value of real estate is the income which it is capable of producing over a long period of years. The income here used is of course the *net* income, left to the owner after all expenses and costs, such as those of upkeep, operation, and main-

tenance, have been deducted. A large portion of business property and apartment houses are held as income producers. Practically all real estate is potentially capable of earning an income; hence this approach to real estate value has a wider application than might at first appear.

These are some of the ways in which real estate value expresses itself; each of these must be taken into consideration in arriving at an estimate of value. At present, however, it is difficult to weigh each of these and to combine them into a value estimate. No definite proportions or weights have been worked out which may be taken as guides in making the combination. This situation is in part due to the fact that our knowledge of the movement of real estate values is limited. Such knowledge of their movement as exists is practically confined to the memories or private records of individuals dealing in real estate or investing in it. With these it is a matter of *general observation*. Since the observation of individuals is limited in its scope, both as to time and as to place, such knowledge is sketchy, indefinite, and ephemeral. It lacks the support of statistical research which could give it greater definiteness, scope, and permanence.

But the development of such statistical support waits, in turn, upon the discovery of statistical devices peculiarly adapted to the study of the phenomenon of real estate value. The devices or methods ordinarily employed are insufficient or unsatisfactory in this particular field.

The present study makes its contribution at just this point; it presents a method of analyzing and studying the movement of real estate prices as a whole, based on the price asked in successive listings of the same properties. The method lends itself to the use of real estate dealers, real estate boards, especially those that have multiple listing systems, students of real estate, and others interested. The method is so simple that it can be applied easily and quickly to data available in nearly every community.

This is an example of the contribution which research may be expected to make in this field. The purpose of research is not to supplant the element of human judgment, but to supply a base upon which it can rest; to reduce its errors by giving it a better vantage point; to supplement or correct its conclusions with an array of dependable facts dug out of past records or experience. Research must push back the boundaries of knowledge into the realm of opinion and unfounded con-

jecture; it must substitute accurate information for general impression.

This is a laborious process requiring the examination of great masses of material to discern the underlying principles that assert themselves in diverse and sometimes perplexing manifestations. It is not safe, however, to draw conclusions on any other basis. Economic relationships are too complex to permit of hasty deductions from scanty materials.

Research in the general field of land utilization and real estate management is comparatively new; hence the temptation to generalize from insufficient data is especially strong. But this temptation must be resisted. Emphasis must be placed rather on building up the data. This requires intensive studies of restricted areas where the forces at work can be more accurately segregated and their influences distinguished.

When adequate data have been provided, the discernment of underlying principles will be simpler. And it will also be possible to distinguish between the operation of fundamental forces and the presence of temporary aberrations. Until data are adequate, the two may be so closely intermingled as to cause hopeless confusion.

ERNEST M. FISHER,

Associate Professor of Realty Management

AUTHOR'S NOTE

The material contained in this bulletin is taken from data collected in the preparation of a dissertation which is to be submitted to the faculty of the Graduate School of the University of Michigan in partial fulfillment of the requirements for the degree of Doctor of Philosophy.

The study was undertaken originally at the suggestion of Professor Edmund E. Day, Dean of the School of Business Administration and Chairman of the Department of Economics, and the collection of the material and a large part of the analysis were completed while the author was enrolled as a graduate student in the Department.

The author wishes especially to acknowledge his indebtedness to Dean Day for many suggestions made at various stages of the study; to Mr. L. D. Carr, of Ann Arbor, for very active cooperation in the collection of the original data; to Mr. George H. Sandenburgh, City Engineer of Ann Arbor, for placing at his disposal the facilities of his department, and to Professor Ernest M. Fisher, for assistance in the preparation of this bulletin.



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AN INDEX OF LOCAL REAL ESTATE PRICES

SUMMARY

Everyone who sells or buys real estate whether as a broker or as a principal is concerned with the course of real estate prices; he wants to sell when prices are at or near the peak; and he wants to buy when they are low. The difficulty lies in telling when these points are reached.

Heretofore reliance has been placed upon general observation in making decisions regarding the duration and extent of real estate price movements. These movements have been subjected to no critical statistical analysis that would throw any light upon them or accurately define their limits. Real estate dealers and experienced investors have been obliged to depend upon their judgment, supported only by casual classification and unsystematic analysis of the facts.

As a matter of fact, a careful analysis of real estate price movements is difficult to make. There are two reasons for this situation. In the first place, data on real estate transactions are scanty and unsatisfactory. The only public record of a transaction is found in the recorded deed, and this seldom contains any information regarding price. Furthermore, many transactions do not involve the transfer of title by deed for a long period after they have been consummated.

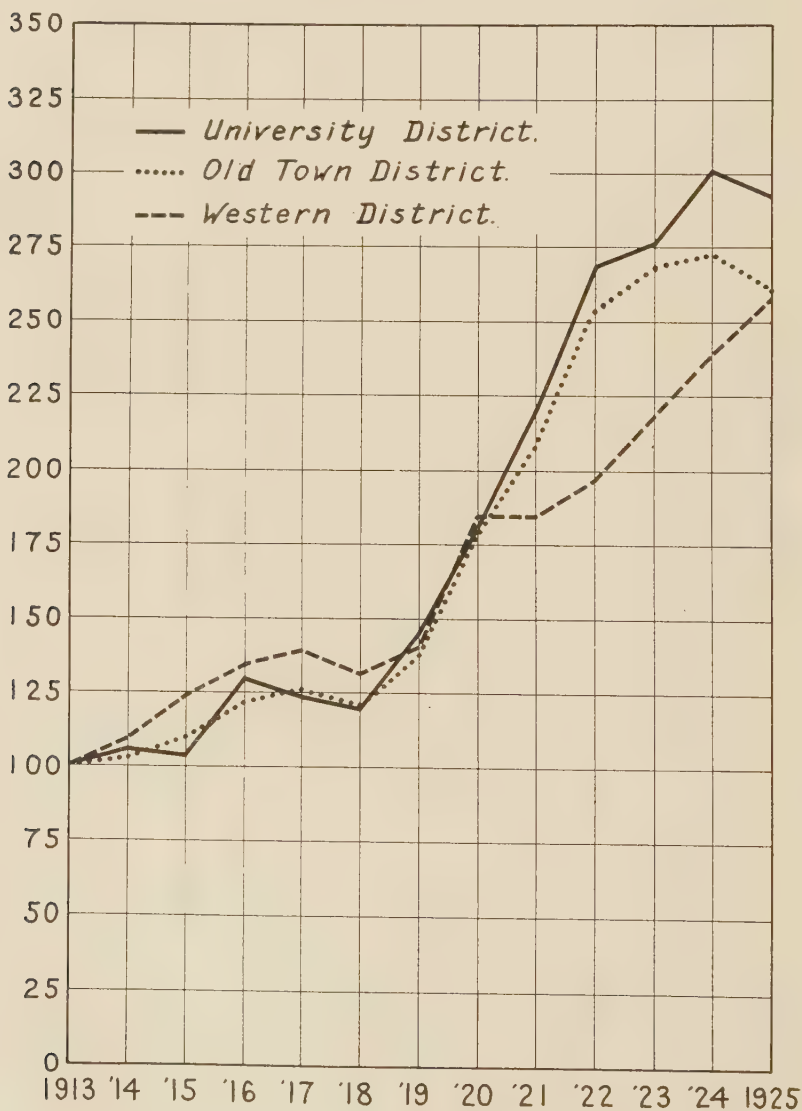
Secondly, an analysis of real estate prices is difficult because every parcel of real estate is unique. There is consequently no series of price quotations that can be used in the ordinary way for the construction of an index of prices.

This study presents a method of overcoming these difficulties. The method is simple and apparently adaptable to use in any community. It consists of constructing an index based on the prices at which identical properties are re-listed for sale at irregular intervals. In the present study the method is applied to the prices of real estate in Ann Arbor, Michigan, from 1912 to 1925. Over 5,000 listings were examined, and about 2,000 quotations of asking price were used in the final computations.

The listings were sorted into three groups so as to bring together

FIGURE 1

THE COURSE OF THE INDEX OF REAL ESTATE PRICES IN THREE HOMOGENEOUS DISTRICTS OF ANN ARBOR, MICHIGAN, FROM 1913 TO 1925.



in each group as far as possible properties located geographically where they would be affected by the same forces. Hence three series of index numbers were developed. Their courses are shown in *Figure 1*, the index numbers being given numerically in TABLE I.

The indexes rose gradually from 1913 to 1916 and 1917. A gentle decline then began which lasted through the year 1918. After the conclusion of the Great War in 1919 a rapid ascent began, lasting until 1924. During this time, one of the indexes reached a point as high as 308. In 1925 prices declined.

During this period there were wide fluctuations in the general price level, and these fluctuations are reflected in the indexes of real estate prices. To eliminate this influence as far as possible, the indexes of real estate prices were divided by the Bureau of Labor Statistics' All Commodity-Wholesale Price Index. (The indexes thus obtained may be considered deflated.) The results in this revised form are shown in *Figure 2* and in TABLE II.

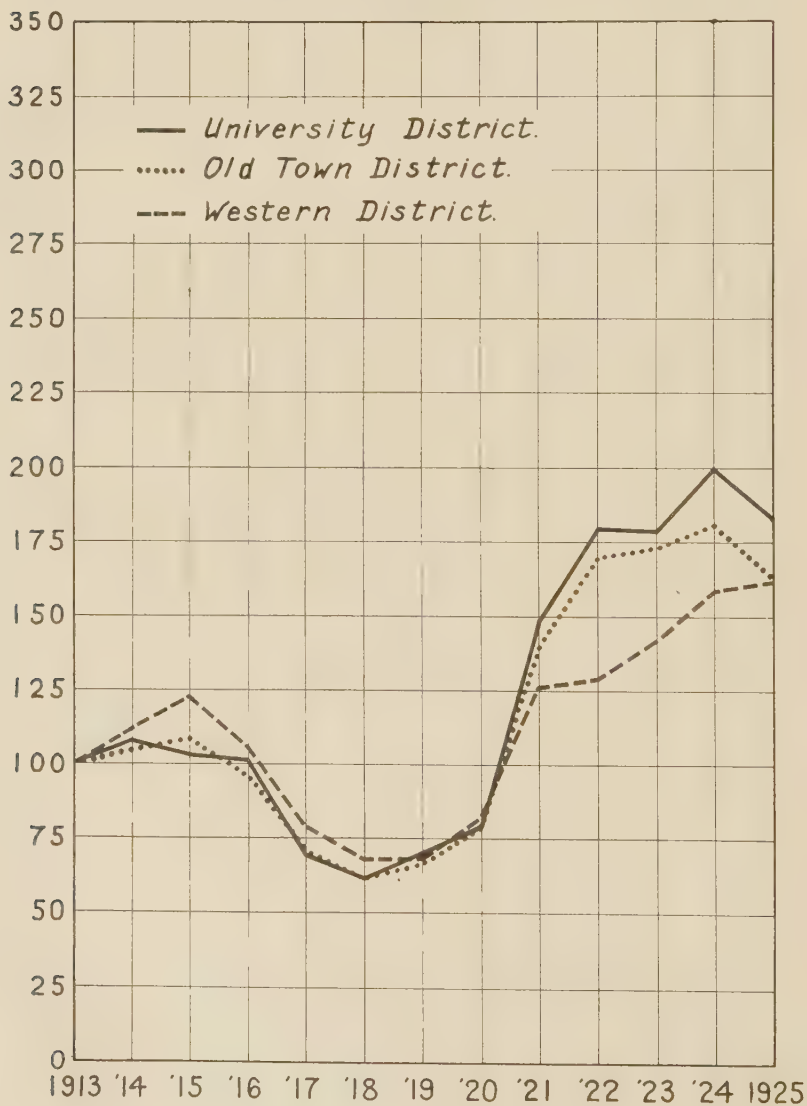
At the beginning of the period of the study the deflated series tend in the same upward direction as the original indexes; but the downward turn occurs earlier, is much more precipitous, and continues until 1918 when the three indexes stand from 35 to 40 points below the level of 1913, instead of from 20 to 38 points above it. From 1918 to 1920, the rise of the deflated indexes is more gradual than that of the original; but from 1920 to 1922 the revised series leap above the 1913 level and attain a height as great as 82 points above it. The highest point in these new series—like that in the original, is also reached in 1924; but it is 204 instead of 308 as in the original series.

A comparison of these indexes with indexes of the growth of population in Ann Arbor and of the costs of construction yielded suggestive but inconclusive results. These are set forth at the close of the study.

The significance of this study lies in the development of a new method of price measurement applicable to the study of real estate price movements. It is clearly recognized that the data are not adequate to the development of a series of index numbers which would have any general application to the study of the movement of real estate prices over the country as a whole. But applied locally, although the

FIGURE 2

THE COURSE OF THE "DEFLATED" INDEX OF REAL ESTATE PRICES IN THREE HOMOGENEOUS DISTRICTS OF ANN ARBOR, MICHIGAN, FROM 1913 TO 1925. (ORIGINAL INDEXES DIVIDED BY WHOLESALE PRICE INDEX).



data were scanty, and although the period covered was one of violent economic disturbance, the method has given results that coincide on the whole with the judgment of real estate dealers and careful observers in the community. It would seem, therefore, to possess considerable potential value.

THE PROBLEM INVOLVED

In recent years there has been a great increase in the amount of accurate knowledge regarding the course of business conditions. For many decades periods of "good" business have alternated with periods of "poor" business. But only within the last decade or two have careful statistical analyses of the various elements in the general business composite been made. As information regarding the behavior of different components of business conditions increases, it becomes more and more evident that there is a relationship existing between them that is more or less systematic. As a result, business is being done with a clearer understanding of the forces affecting it in various stages.

Index numbers representing price behavior are one of the chief instruments used to analyze these forces. A series of index numbers shows as accurately as it is now possible to show, what happens to the

TABLE 1—INDEXES OF REAL ESTATE PRICES IN ANN ARBOR, MICHIGAN, 1913-1925

Year	University District Index	Old Town District Index	Western District Index
1913	100	100	100
1914	106	103	110
1915	104	110	124
1916	130	122	135
1917	124	126	140
1918	120	121	132
1919	145	138	141
1920	181	179	185
1921	219	208	185
1922	268	254	192
1923	276	267	219
1924	301	272	239
1925	292	261	258

prices of a group of related commodities—approximately when the prices as a whole are increasing, at what point they reach their peak, and at what time they decline. Index numbers, in other words, have been commonly employed to trace the course of commodity prices.

Heretofore, no information of this sort has been available regarding the prices of real estate. Not even sales records have been compiled and kept for reference. No effort has been made to assemble, classify, and interpret transactions in this fundamental economic commodity. But it would seem reasonable to suppose that an index of real estate prices would be of value to all who invest in real estate as well as to those whose business it is to negotiate real estate transactions and to advise regarding them. This study is an attempt to construct an index that will portray the course of real estate prices as the indexes of other commodity prices reflect their behavior.

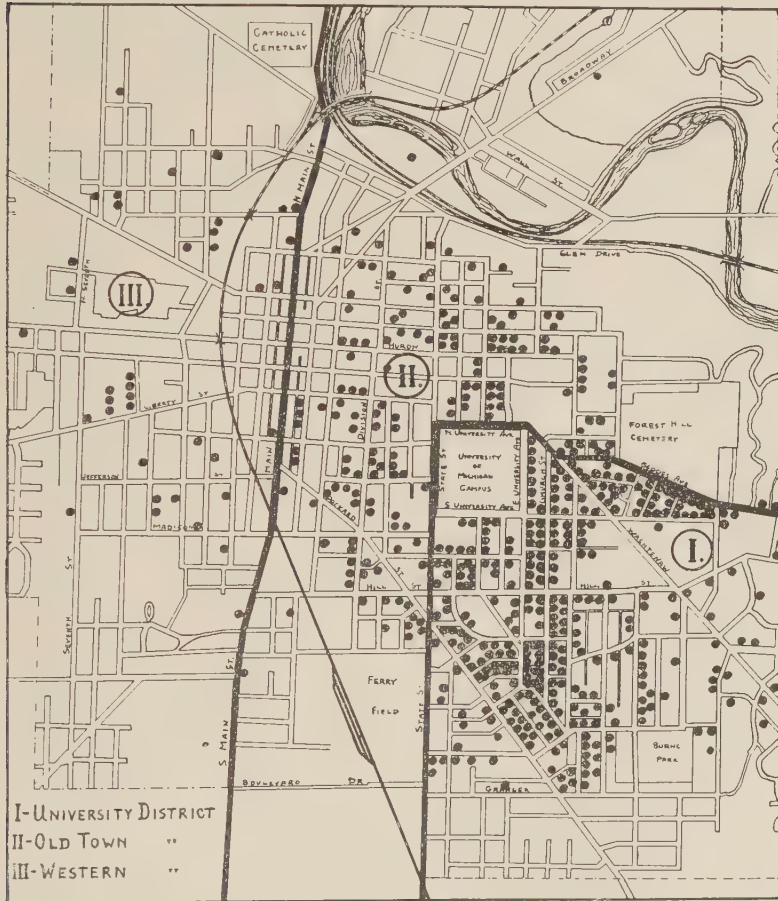
Some serious complications at once arise. First of these is the fact that every piece of real estate is unique, both as to its original

TABLE II. BUREAU OF LABOR STATISTICS' ALL COMMODITY WHOLESALE PRICE INDEX, WITH THE DEFLATED INDEXES OF REAL ESTATE PRICES
IN ANN ARBOR, MICHIGAN

Year	B. of L. All Commodity Wholesale Price Index	University District Index ÷ B. of L.	Old Town District Index ÷ B. of L.	Western District Index ÷ B. of L.
1913	100	100	100	100
1914	98	108	105	112
1915	101	103	109	123
1916	127	102	96	106
1917	177	70	71	79
1918	194	62	62	68
1919	206	70	67	68
1920	226	80	79	82
1921	147	149	141	126
1922	149	180	170	129
1923	154	179	173	142
1924	150	200	181	159
1925	159	184	164	162

FIGURE 3

THE THREE DISTRICTS AND THE DISTRIBUTION OF PROPERTIES STUDIED IN THE DISTRICTS INTO WHICH THE CITY OF ANN ARBOR WAS DIVIDED



quality of location, and as to the type, age, quality, and condition of the improvements that have been erected on it. For measuring the price fluctuations of standardized commodities such as foods, the method of constructing index numbers from series of market quotations is familiar. In all these cases, the unit remains fairly constant; the chief fluctuations are in price. In real estate transactions, from one transaction to another both the nature of the unit and the price change;

quotations on the identical commodity are far apart; there is no standardized unit to which all quotations may be reduced; and the prices fluctuate probably as widely as those of other commodities. This fact alone would make the ordinary method difficult if not impossible to use.

Another complication is found in the fact that few real estate sales are "typical" ones. In a large number of transactions there is some unusual factor to reckon with, such as a keen desire on the part of the seller to sell, or particular considerations that will influence the purchaser to pay more than the best judgment and current market conditions would justify. Conclusions can be drawn, therefore, only on the basis of numerous cases.

Finally, there is no dependable public source of information regarding the actual consideration involved in a transaction. For more or less obvious reasons, more frequently than not, one or both parties to a sale of real estate wish to conceal the price.¹ Considerations mentioned in deeds or conveyances are usually nominal. Revenue stamps previously required under the Federal Revenue Act are not reliable, since by placing more stamps on the document than the law required either party to the transaction could make the price appear greater than it actually was. As a matter of fact, this was frequently done during the period of rising prices by speculative purchasers who "bought for the rise."²

In short, the difficulties attendant upon the effort to secure and use actual selling prices are so great as to render such procedure practically impossible.

Another device was employed in this study, therefore, as a substitute for the usual methods used in collecting price data and analyzing them. This device is simple and universally available; it is believed, therefore, that its description in detail will be worth while. The particular *locale* to which it is has been applied is Ann Arbor, Michigan, a

¹A notable exception is found in transactions consummated by trustees or others acting in a fiduciary capacity, who usually wish as a matter of protection to have the actual consideration received made a matter of record.

²The deception thus practiced was the basis of representations made by the National Association of Real Estate Boards in successfully urging the repeal in 1926 of the tax on deeds formerly required under the Federal Revenue Act.

city of twenty-five thousand population. Here is situated the University of Michigan, with some ten thousand students enrolled; these increase the number of people within the city limits to about thirty-five thousand. The method could be applied with as good results to a city of any size above this; in fact, it would be feasible in any community where real estate turnover is rapid enough to give any appreciable significance to fluctuations in real estate prices.

As a substitute for actual selling prices, the asking or listing prices were chosen. It may be urged that the listing price is in a large number of cases higher than the final price accepted to close the transaction. This was frankly acknowledged. But the listing price, it is assumed, bears a fairly constant relationship to the price received. If a sufficient number of cases be taken, therefore, it is believed that listing prices will reflect fluctuations accurately enough for present purposes. There is in favor of accepting them the fact that cases of necessitous sellers and over-eager buyers do not appear. An owner who desires to sell presumably places what he and his broker consider to be a fair price on the property. In the process the element of tenseness and the fear of losing a particular sale do not enter.

To secure the data the record of all the listings received in the office of a leading real estate firm³ in Ann Arbor was examined. More than five thousand listings were tabulated.

The listing records were sorted so as to bring together the successive listings of identical properties. By comparing the description of a property given in subsequent listings with that in the first, it was possible to determine with considerable accuracy whether any substantial changes, alterations, or improvements had been made. When it appeared that between listings such changes had occurred in the property, the listing was discarded. Neither could any of the properties that had been listed but once during the period be used, as will be seen. The listings that remained, therefore, represented successive asking prices for the same properties over a period of years. On some of the

³The author wishes to express his appreciation of the kindness of the firm of Carr and Tremmel, composed of Messrs. L. D. Carr and C. J. Tremmel, who placed the complete records of their office at his disposal. Without such cooperation, this study could not have been made.

TABLE IV. RELATIVE LISTING PRICES PLACED, WHEN THEY WERE SUBSEQUENTLY LISTED, ON PROPERTIES IN THE UNIVERSITY DISTRICT OF ANN ARBOR, MICHIGAN, WHICH WERE FIRST LISTED IN 1912.

	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925
	96	97	103	150	133	127	121	221	190	320	318	348	318	
	94	120	97	120	122	104	140	180	250	355	300	264	264	
	132	175	120	167	110	140	150	173	245	300	250	320	300	
	100	108	133	126	135	113	147	309	184	...	412	313	271	
	87	107	100	106	106	113	132	194	236	...	400	275	319	
	108	105	109	...	106	118	170	186	104	...	255	400	364	
	...	112	107	107	111	113	136	231	250	...	316	271	333	
	...	100	100	174	100	95	206	192	240	...	328	255	332	
	...	90	109	127	130	167	145	183	...	...	300	238	263	
	...	96	100	175	133	...	140	167	268	...	275	...	...	
	...	136	103	103	180	...	...	...	...	...	...	395	...	
	...	100	91	131	100	...	180	200	208	...	263	386	338	
	...	106	87	250	113	...	182	196	267	...	283	275	329	
	...	114	100	...	123	...	118	179	273	...	367	233	167	
	...	87	114	...	134	...	158	200	...	...	282	357	217	
	...	100	109	...	105	...	153	...	...	...	217	367	...	
	...	104	100	...	131	...	152	...	...	...	365	217	...	
	...	117	103	...	131	...	185	...	...	...	350	...	...	
	...	120	97	...	...	...	143	...	...	...	350	...	...	
	...	105	106	...	...	...	143	...	...	...	150	...	...	
	...	etc.	etc.	...	...	...	118	...	...	...	300	...	...	
Medians	100	106	103	130	122	113	149	193	240	325	304	294	309	
No. of Relatives	6	21	27	12	18	9	20	14	13	3	20	16	14	
Link-Relatives	100	106	97	126	94	93	132	130	124	135	94	97	105	

Base Year = 100

properties but two prices were obtained; on others an asking price had been placed repeatedly.

The problem then resolved itself into that of constructing an index of these successive asking prices, scattered throughout the period from 1912 to 1925 and representing properties of a wide range of value. Residential properties were far in the majority, and single-family dwellings were the predominant type.

A first-hand study of the structure of the city of Ann Arbor and of the forces and institutions that affect the real estate in it made it seem advisable to make another division of the data. There are in Ann Arbor, as in many other cities, certain districts that are homogeneous in themselves but more or less distinct from the other sections of the city. For the purposes of this study three sections were recognized and the listings segregated according to the district in which the property lay. The districts chosen were (1) the University District, where the influence of the University of Michigan is the dominant force affecting real estate values; (2) the Old Town District where real estate conditions are more static than in either of the other two districts and where the commercial and rooming house areas are located; and (3) the Western District where property values are lower and where such industries as exist in Ann Arbor are located. (See *Figure 3*.)

PRELIMINARY TREATMENT OF THE DATA

The treatment of the data for each of the three districts was the same except where otherwise noted; it will be sufficient therefore to describe in detail the method used as it applies to one of these districts. For this purpose the University District has been chosen.

In the first place, a table was constructed showing in the stubs the address of the properties and in the captions the years 1912 to 1925. Then the prices asked for the properties when they were listed were entered in the the appropriate row and column. (See TABLE III.) All asking prices subsequent to the first were then converted into percentages of the *first* asking price. (See *italics* in TABLE III.) Thus a relative or series of relatives (in case the property was listed more than twice), based on the first asking price as 100, was obtained. For example, the first property shown in TABLE III is that located at 718

Arbor Street, and it is shown as having been listed first in 1917 at the price of \$4,200. In 1920 it was listed at \$8,000, 190 per cent of the former asking price. The property at 815 Arch Street was listed first in 1912 at a price of \$3,300; in 1919 at \$4,000; in 1923, at \$10,500; again in 1924 at \$11,500; and finally in 1925 at \$10,500. Using the original asking price as the base (100), the subsequent prices are represented by the relatives, 121, 318, 348, 318. These relatives might be taken as a crude index of the fluctuations in the value of this particular property. But such an assumption would be hazardous, for it is impossible to know what unique elements entered into the asking price in any particular case. And it is not justifiable, of course, to assume that the asking prices on any *one* property represent the market as a whole.

The next step, therefore, is to devise a method of combining all the relatives thus derived into an index that will be more reliable because of the larger number of cases involved and the consequent compensation in variations.

This called for the construction of a series of tables. In each table were brought together the relatives representing subsequent listing prices asked for property that was first listed in a particular year. Thus in TABLE IV relative listing prices of all properties first listed in 1912 are gathered together and each relative entered in the column which represents the year of the subsequent listing. A similar table was constructed for each of the following years, 1913-1924.

These tables show at a glance the variations in the relative prices asked in successive listings of different properties all of which were first listed in the same year; the variations in these relatives indicate clearly the necessity for using an average rather than an individual series as an index of the fluctuations. The median relative for each year was chosen as the average which best represented the relationship between original listed price and the price asked for properties relisted during the particular year.⁴ The result was a series of indexes showing the relationship between real estate prices in each base year and the subse-

⁴For a discussion of the characteristics of the median as an average, see Day, Edmund E., *Statistical Analysis*, (New York, 1925) Chapter X; also Yule, G. Udny, *An Introduction to the Theory of Statistics*, (London, 1922) pp. 116 ff.

quent years in the period. The entire group of series is shown in TABLE V. The next step was to combine all these indexes into one.

To accomplish this step, the indexes shown in TABLE V were first converted into link-relatives. The link-relatives show the relationship which the index for a given year bears to the index of the preceding year, rather than to the year when the property was first listed. These were then substituted for the indexes contained in TABLE V, and are presented in TABLE VI. The items in each of the columns of this table represent an average relationship between the price asked for real estate in the given year and that asked in the year preceding. Thus, for example, the seven figures in the 1919 column are seven criteria of the change in real estate values between 1918 and 1919; and so on. An average of the several link-relatives in each column should indicate fairly accurately the change which actually occurred.

But each of these figures is based on a number of actual listings; in order to give each its proper weight it must be known what number of listings it represents. Into TABLE VI, therefore, the number of items which the link-relative given represents was entered (See *italics* in TABLE VI). These numbers were used as weights and the weighted median found for each year. The result, shown in the designated row in TABLE VI, is a combined index in link-relative form.

In order to convert these link-relatives into an index that refers back to a given base, it is necessary only to multiply the link-relative for the base year by the link-relative following it, multiplying the product by the link-relative following it, and so on through the series. The year 1913 was chosen as the base 100. The indexes thus obtained were as follows:

YEAR	INDEX	YEAR	INDEX	YEAR	INDEX	YEAR	INDEX
1912	100	1916	130	1920	174		
1913	100	1917	122	1921	216	1924	300
1914	106	1918	118	1922	292	1925	291
1915	103	1919	140	1923	275		

A SUPPLEMENTARY INDEX

From the material collected as described it is possible to construct a supplementary index with which to check and correct, if necessary, the index previously derived.

It was observed that there were several instances in which proper-

TABLE VI. LINK-RELATIVES COMPUTED FROM THE THIRTEEN SERIES SHOWN IN TABLE V, WITH THE NUMBER OF LISTINGS UPON WHICH EACH LINK-RELATIVE IS BASED (in *italics*)

	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925
1912 .	...	(6) 100	(21) 106	(27) 97	(12) 125	(18) 94	(9) 93	(20) 132	(11) 130	(13) 124	(3) 135	(20) 94	(16) 97	(14) 105
1913 .	...	...	(7) 100	(9) 105	(1) 120	(6) 103	(8) 88	(11) 116	(8) 120	(7) 131	...	...	(5) 119	(6) 106
1914 .	...	...	...	(8) 100	(5) 102	(10) 113	(8) 100	(12) 120	(6) 114	(2) 140	...	...	(7) 118	(4) 104
1915 .	...	...	...	...	(4) 115	(2) 97	(5) 104	(11) 110	(5) 146	(1) 110	(2) 123	(8) 100	(4) 124	(2) 78
1916 .	...	...	...	...	...	(4) 92	(2) 97	(7) 133	(10) 120	(2) 132	...	...	(1) 113	(1) 125
1917 .	...	...	...	...	...	...	(4) 98	(8) 110	(15) 124	(5) 134	...	...	(6) 120	(3) 84
1918 .	...	...	...	...	...	...	...	(9) 119	(6) 120	(5) 124	(1) 157	(2) 76	(4) 109	(3) 108
1919 .	...	...	...	...	...	...	...	...	(11) 125	(14) 112	...	...	(6) 90	(8) 97
1920 .	...	...	...	...	...	...	...	...	...	(8) 119	(2) 134	(1) 98	(3) 103	(2) 101
1921 .	...	...	...	...	...	...	...	...	...	...	(3) 135	(9) 81	(11) 109	(6) 93
1922 .	...	...	...	...	...	...	...	...	...	...	...	(3) 103	(3) 109	(2) 97
1923 .	...	...	...	...	...	...	...	...	...	...	...	...	(10) 101	(10) 98
1924 .	...	...	...	...	...	...	...	...	...	...	...	...	...	(29) 95
Median														
Relatives ...	100	100	106	97	126	94	97	119	124	124	135	94	103	97
Indexes 100	100	100	106	103	130	120	118	140	174	216	292	275	300	291

ties had been listed in two successive years. These cases were tabulated, and the prices asked when the properties were listed the second time were divided by the prices asked the first time and thus converted into relatives. Thus a series of relatives expressing the relationship of prices in a given year to those of the preceding year was obtained. From the series thus found for each year the median was chosen as the average most representative of the group. These averages then constituted another series of link-relatives. To reduce them to the common base of 1913 the relative for 1913 was multiplied by that for 1914; the product was multiplied by the relative for 1915, and so on. The results are shown in TABLE VII, both in the link-relative form and in the "chained" form.

The number of cases upon which this supplementary index was based was much smaller than the number used in making the other calculation. But it will be seen from a study of TABLE VII, where both series are given, that they are very similar. It appeared, however, that some revision of the original index would be desirable in the light of the information contributed by the supplementary index. In TABLE VII the link-relatives of both series are given, with the number (in *italics*) of listings upon which each is based. From these link-relatives a final index is computed, using the number of listings each link-relative represents as weights and finding the weighted arithmetic mean of the two series. In Column "C" of TABLE VII such a revised index is shown.

An inspection of these figures shows that the index for 1922 is higher than that for 1923. Since this situation is contrary to general impression and is difficult to explain and since the index for 1922 was based upon scanty information,⁵ further study was given to these two indexes.

First the relationship between the years 1921 and 1923 was studied. In TABLE VIII the 1921 and 1923 columns of TABLE V, page 13, were transcribed as column "A". In order to find what relationship the figures for 1923 bore to those for 1921, the former were divided by the latter, and the series of relatives shown in column "B" of TABLE VIII

⁵It will be seen from TABLE V that the index for that year was based originally upon the smallest number of listings found in any year of the entire period.

was produced. Into the adjacent column (in *italics*) the number of cases upon which the 1923 indexes were founded was entered, and these numbers were used as weights in finding the average relationship between the two years. Again the median was chosen as the average that best expressed the relationship and was found to be 126. The 1921 index, 219, multiplied by the relative 126 thus found gives 275.94 as the proper relative for 1923. This suggests that the relative 276 which stands in TABLE VII for 1923 is at least high enough.

Another process was applied to the index for 1922 to discover whether it was out of line. According to the data contained in TABLE V, page 13, prices of real estate in 1922 bore the following relationships to prices in subsequent years: 1920—100; 1923—103; 1924—112; 1925—109. Assuming that the indexes for these subsequent years are correct, the index for 1922 could be computed by dividing the index

TABLE VII. THE MAIN AND SUPPLEMENTARY INDEXES USED IN THE CONSTRUCTION OF THE FINAL INDEX OF REAL ESTATE VALUES IN THE UNIVERSITY DISTRICT OF ANN ARBOR

	"A" Supplementary Index			"B" Main Index			"C" ("B" Revised)		"D" Final Index (1922 Cr.).	
	Weights	Link Relatives	"Chained" Relatives	Weights	Link Relatives	"Chained" Relatives	Link Relatives	"Chained" Relatives	Link Relatives	"Chained" Relatives
1912 . . .	..	...	100	..	...	100	...	100	...	100
1913 . . .	9	100	100	6	100	100	100	100	100	100
1914 . . .	5	105	105	28	106	106	106	106	106	106
1915 . . .	9	103	108	44	97	103	98	104	98	104
1916 . . .	4	120	130	22	126	130	125	130	125	130
1917 . . .	7	100	130	42	94	122	95	124	95	124
1918 . . .	6	99	129	36	97	118	97	120	97	120
1919 . . .	17	125	161	81	119	140	121	145	121	145
1920 . . .	17	128	206	75	124	174	125	181	125	181
1921 . . .	21	114	235	57	124	216	121	219	121	219
1922 . . .	3	125	294	11	135	292	133	291	122	268
1923 . . .	5	103	303	43	94	275	95	276	103	276
1924 . . .	15	107	324	76	109	300	109	301	109	301
1925 . . .	29	95	308	90	97	291	97	292	97	292

TABLE VIII. THE RELATIONSHIP BETWEEN REAL ESTATE VALUES IN THE
UNIVERSITY DISTRICT OF ANN ARBOR IN THE YEARS 1921 AND 1923.
(DATA FROM TABLE V)

Year	A		B	
	1921	1923	Weights	1923 1921
1912	240	304	20	127
1913	209	266	3	127
1914	220	270	7	123
1915	209	259	8	124
1916	187	236	4	126
1917	178	206	3	116
1918	177	210	2	119
1919	140	200	8	143
1920	119	157	1	132
1921	100	110	9	110

for each of the subsequent years by the relative indicated in the series just mentioned. This process gave values of 268, 269 and 268 for the index for 1922. Evidently the former index was too high. Consequently it was revised and the value of 268 assigned to it.

The final indexes for the University District are charted in *Figure 1*, and read as follows:

1912—100	1917—124	1922—268
1913—100	1918—120	1923—276
1914—106	1919—145	1924—301
1915—104	1920—181	1925—292
1916—130	1921—219	

THE OLD TOWN DISTRICT INDEX

Precisely the same method as that which has been described was used in computing an index for real estate values in the Old Town District. A main index and a supplementary index were constructed and then compared. On the basis of the material contained in TABLE IX the main index was corrected as previously described and a final index thus arrived at, shown in column "C" of TABLE IX. In this case it was not necessary to correct the item for any particular year. These indexes are given in TABLE I, and charted in *Figure 1*.

TABLE IX. THE SUPPLEMENTARY, MAIN, AND FINAL INDEXES OF REAL ESTATE VALUES IN THE OLD TOWN DISTRICT OF ANN ARBOR, 1912-1925

Year	A Supplementary Index			B Main Index			C Final Index	
	Weights	Links	Chained	Weights	Links	Chained	Links	Chained
1912	..	..	103	..	..	103	..	103
1913	11	97	100	10	97	100	97	100
1914	4	104	104	24	103	103	103	103
1915	2	119	124	14	105	108	107	110
1916	3	118	146	17	110	119	111	122
1917	4	102	150	17	103	123	103	126
1918	2	89	134	9	97	119	96	121
1919	2	106	142	24	115	137	114	138
1920	5	115	163	27	133	182	130	179
1921	9	117	191	28	116	211	116	208
1922	1	118	225	7	122	257	122	254
1923	2	122	275	36	104	267	105	267
1924	9	107	294	49	101	270	102	272
1925	14	98	288	72	96	259	96	261

THE WESTERN DISTRICT INDEX

The same methods were used as far as possible in constructing an index of real estate values for the Western District. On account of lack of material here, however, it was not possible to confine the treatment to any one method. The blank spaces in TABLE X indicate instances in which there was no material at all. In many of the other cases there was but one relisting upon which the index could be founded. Furthermore, so few were the cases of relisting in successive years that it was impossible to formulate a supplementary index. There were but about one hundred and fifty listings in this district, while in the University District the study was based upon some twelve hundred, and the study of the Western District embraced about seven hundred and fifty.

Upon the data contained in TABLE X indexes were constructed, by the same method as was used to compute the main index for the other sections, for the years 1914, and 1920 to 1925. But the information was too scanty between the years 1915 and 1919 to justify any

TABLE X. TWELVE SERIES OF INDEXES OF REAL ESTATE PRICES IN THE WESTERN DISTRICT WHICH WERE COMBINED TO FORM THE MAIN INDEX

	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925
1913 . 100	(7) 110	(1) 117	(1) 143	(2) 186	...	(4) 141	(1) 222	...	...	(1) 128	(1) 319	(1) 214	
1914	100	...	...	...	...	...	(1) 160	...	...	...	(1) 313	(1) 229	
1915	...	...	100	...	...	(1) 100	...	(1) 188	...	...	...	(2) 201	
1916	...	...	...	(2) 120	...	...	(1) 171	(1) 193	...	...	...	(1) 292	
1917	...	...	...	100	...	(1) 100	(4) 118	(1) 194	(1) 151	(3) 169	(2) 171	(3) 224	
1918	...	...	...	...	...	100(2) 107	...	(1) 194	...	...	...	(1) 173	
1919	...	...	...	...	...	...	(1) 161	(3) 150	...	(1) 269	...	...	
1920	...	...	...	...	...	...	100	(2) 101	(1) 131	(1) 153	(2) 116	(4) 143	
1921	...	...	...	...	...	...	...	100	...	(2) 100	(1) 127	(3) 132	
1922	...	...	...	...	...	...	...	...	100	(1) 117	...	...	
1923	...	...	...	...	...	...	...	...	...	100	(3) 113	(3) 117	
1924	...	...	...	...	...	...	...	...	...	...	100	(4) 108	
Indexes 100	110	124	135	140	141	185	185	185	192	219	239	258	

conclusions that might be formed upon this basis alone; additional information had to be sought.

The index for the year 1919 may be based directly on 1913, since there are four listings which first appeared in 1913 that reappeared in 1919. The index for 1919, if thus taken directly from 1913, is 141, a figure which corresponds fairly accurately with the index for this year in the other two series.

For the years 1915 to 1918 indexes have to be devised by a study of the relationship of these years to every other year, as indicated by the recurrence of individual listings. Thus according to the information contained in TABLE X, the index for 1915 was 117, based upon one listing which first occurred in 1913, and subsequently in 1917; according to another listing, it has the same value as the index for 1918; in another case, 1915 has a value of 100 when 1921 has a value of 188. Since the value of 1921 has already been found to be 185, the value of 1915 in this instance would be 98. Similarly, on the 1915 base, 1925 has a value of 201. The index for 1925 has already been found to stand at 258. The actual value of 1915, so far as it is shown by the two relatives, then, is 128.

In this way as many values as possible were found for each of the years, and their average, or the average of the three middle items, was taken as the index for the given year. The series of indexes thus found is given in TABLE IX, in the bottom row, and is charted in *Figure 1*.

A COMPARISON OF THE THREE INDEXES

In general the indexes of prices in the different districts are similar. The trend upward is maintained at approximately an even pace, breaking at intervals fairly evenly spaced.⁶ The striking differences are those of degree rather than direction. The index for the University District is distinctly higher than the others after the year 1921, but it breaks, as does also the index for the Old Town District, in 1924. It drops somewhat more (from 130 to 120) between 1916 and 1918, while the other two continue upward until 1917 and then decline. The University District index outstrips the Old Town District index for

⁶See Figure 1, page 2.

the year 1924 by 29 points; but both decline at about the same rate in 1925, the former to 292 and the latter to 261.

The Western District index remains consistently above the others until the year 1919, when it is topped by a narrow margin by the University District index, regaining what was lost in 1920, and then falling behind on account of a lag that lasted until 1923. In 1925, however, the Western District index was still pointed upward, while the other two were falling. The Old Town District index and that for the Western District were at approximately the same point in 1925.

These variations suggest at once the analysis of some of the forces affecting real estate prices in each district. In the University District the University of Michigan is the largest single factor to reckon with. Its growth is probably best reflected in the increase in enrollment of students. (See TABLE XI.) In *Figure 4* this enrollment is charted in relatives of the enrollment in the year 1912-1913. On the same chart the index for real estate prices in the same district is shown. It will be noted that there is a definite correlation between the two, although

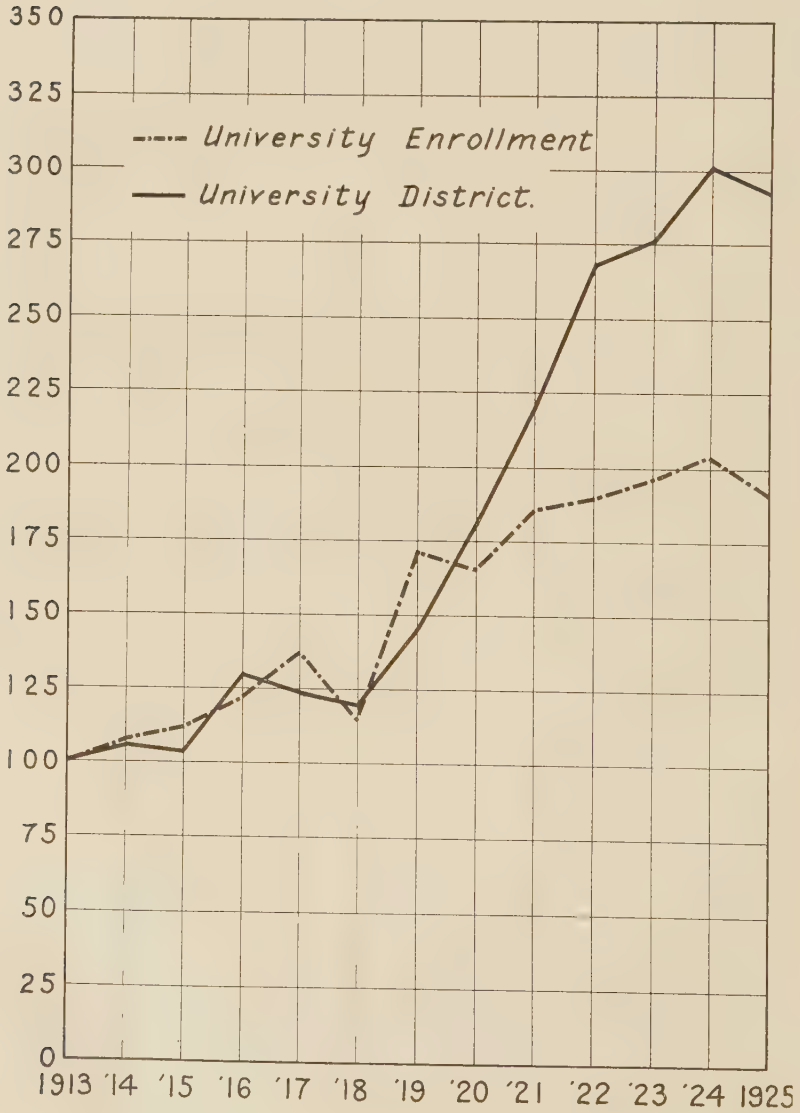
TABLE XI. ENROLLMENT IN THE UNIVERSITY OF MICHIGAN, 1912-1925

School Year Sept. to June	Absolute Numbers	Relatives	Link Relatives
1912-1913	5099	100	...
1913-1914	5520	108	108
1914-1915	5763	112	104
1915-1916	6284	122	109
1916-1917	6601	138	105
1917-1918	5932	115	90
1918-1919	8857	171	149
1919-1920	8560	166	97
1920-1921	9611	186	112
1921-1922	9803	190	102
1922-1923	10068	196	103
1923-1924	10506	204	104
1924-1925	9755	191	92

from the year 1922 the gap between them grew constantly wider until 1924. Real estate prices in this district all this time were increasing at a more rapid rate than the enrollment in the University.

FIGURE 4

COMPARISON OF REAL ESTATE PRICES IN THE UNIVERSITY DISTRICT OF ANN ARBOR
AND UNIVERSITY ENROLLMENT. (1912-13 ENROLLMENT EQUALS 100).



The fact that the general business depression of 1920 is not reflected in prices in this district is accounted for by the nature of the institution. The enrollment increased, as a matter of fact, and the district went unscathed. But the Old Town District index reflects the influence of "hard times" during this period. Thus the greatest variation in the movements is accounted for.

The continuation of the upward swing of the Western District index during 1925 is probably due to the fact that building in this district lagged considerably behind that in the other two, and a post-war shortage of buildings doubtless remained longer there than in the other districts. This conclusion is borne out by the observations made by real estate dealers in Ann Arbor.

The prosperous years 1914-1918 kept this index higher than the other two; and again in 1920 it stood above them. But the business depression of 1921 and 1922 was felt more severely in this district than in the others where the University played an important part in keeping prices stable and the market moving. In fact, in the University and Old Town districts the influence of the University was so potent a factor in counteracting the business depression that one of the experienced real estate dealers made the statement that "here we did not feel it at all."

THE INDEXES AND THE PURCHASING POWER OF THE DOLLAR

The series of indexes which have been presented reflect two economic phenomena; namely, changes in the price of real estate and changes in the purchasing power of the money which those prices represent. The price of \$10,000 paid for a home in 1925 does not represent the same expenditure of purchasing power as it would have represented in 1912; the same amount of money today would buy fewer other commodities than in 1912. The next step, therefore, is to determine what the course of real estate prices has been in terms of a constant unit; that is, in terms of other commodities and the general price level.

To do this, it is necessary to divide the indexes of real estate prices by an index of the general price level. For this purpose the Bureau of Labor Statistics' All Commodity Wholesale Price Index was chosen as probably the one which reflects most accurately the fluctuations of

the general price level.⁷ This index is given in TABLE II. The results of dividing the three indexes of real estate prices in Ann Arbor by the index of wholesale prices are also shown in TABLE II and are charted in *Figure 2*.

As would be expected, the chief result of this process is to reduce the level of the indexes of real estate prices. This is due to the increase in the general price level. Part of the increase in real estate prices was necessary to enable real estate to retain the same general position respecting other commodities. In the period of rapidly rising prices from 1918 to 1920, the effect of their increase was so great as to force the indexes of real estate prices below their level in 1913. That is, real estate prices were not rising in this period so rapidly as were the prices of other commodities. But when general prices began to decline in 1920, the price of real estate regained the level of 1913. From 1920 to 1921 the price of real estate increased and the price of other commodities declined, thus accelerating the tendency for real estate price levels to regain their former position.

The general price level rose gradually from 1921 to 1923, but real estate prices were rising so much faster during these two years that the index of real estate prices continues to rise. The influence of the general price level from this point on is to reduce the level of the real estate indexes, but not materially to change their direction. The position of real estate prices in 1925 was considerably above that in 1913, and further above it than were the prices of other commodities. In other words, the increase in real estate prices had been greater than the increase in the prices of other commodities. Real estate was relatively high in price in 1925.

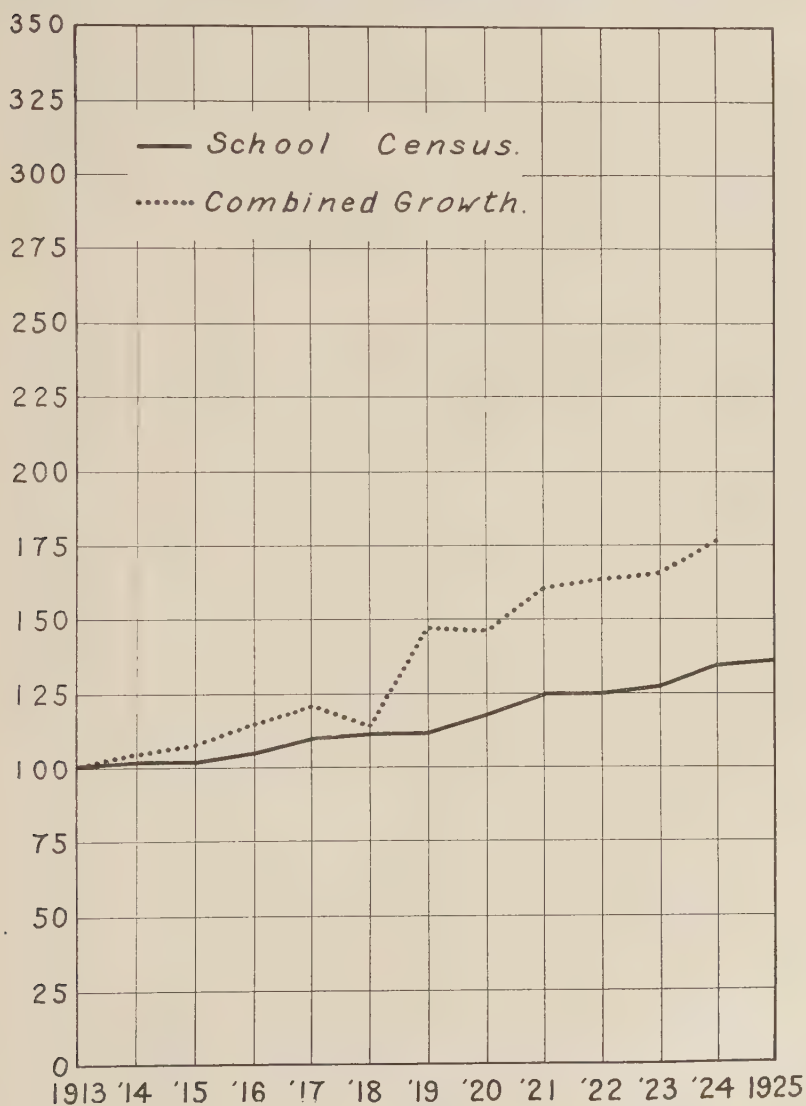
THE INDEXES AND THE GROWTH OF POPULATION

In *Figure 5* the growth of the population of Ann Arbor, as reflected in the school census, is shown. (The absolute and relative figures are given in TABLE XII.) The chart is made from relatives of the population in 1913. A steady growth is indicated, which is doubt-

⁷This index is constructed from price quotations obtained on 404 commodities. For a description of the method used in computing it, see Bureau of Labor Statistics *Bulletin No. 284*.

FIGURE 5

GROWTH OF ANN ARBOR AS REFLECTED IN THE SCHOOL CENSUS AND IN THE COMBINED FIGURES FOR THE SCHOOL, CENSUS AND ENROLLMENT IN THE UNIVERSITY, 1913-1925. (1913-14 Equals 100).



less one of the factors which go to make for the increases in real estate prices.

On the whole, there is some correlation between the two factors; but the correlation is far too slight to justify any conclusions as to causal relationship existing between them. The dotted line represents a combination of the figures for increases in the school census and in the University of Michigan. There would seem to be some reasons for considering both of these as factors in the growth of Ann Arbor; and if they are so considered, the correlation between growth in population and increase in real estate prices is higher.

THE INDEXES AND CONSTRUCTION COSTS

One of the important factors in the price of real estate is the cost of the construction of buildings. If it were possible to separate the price of the lot from the price of the structure, the effects of a changing level of construction costs could be accounted for and eliminated. But no data are available that will enable this separation to be made. Any attempt to compare the level of construction costs and of real estate prices will have to consider the price of real estate as a whole.

TABLE XII. NUMBER OF SCHOOL CHILDREN REPORTED IN SCHOOL CENSUS OF THE CITY OF ANN ARBOR, MICHIGAN, 1913-1925

Year	A	B	C
	Absolute Number	Relatives	Link- Relatives
1913	3704	100	...
1914	3761	102	102
1915	3786	102	100
1916	3892	105	103
1917	4066	110	105
1918	4132	112	102
1919	4151	112	100
1920	4366	118	105
1921	4642	125	106
1922	4647	125	100
1923	4750	128	102
1924	4982	135	105
1925	5032	136	101

FIGURE 6

THE INDEX OF REAL ESTATE PRICES IN THREE HOMOGENEOUS DISTRICTS OF ANN ARBOR, MICHIGAN, AND THE AMERICAN APPRAISAL COMPANY INDEX OF THE COST OF CONSTRUCTING AN INDUSTRIAL FRAME BUILDING. (1913-1925).

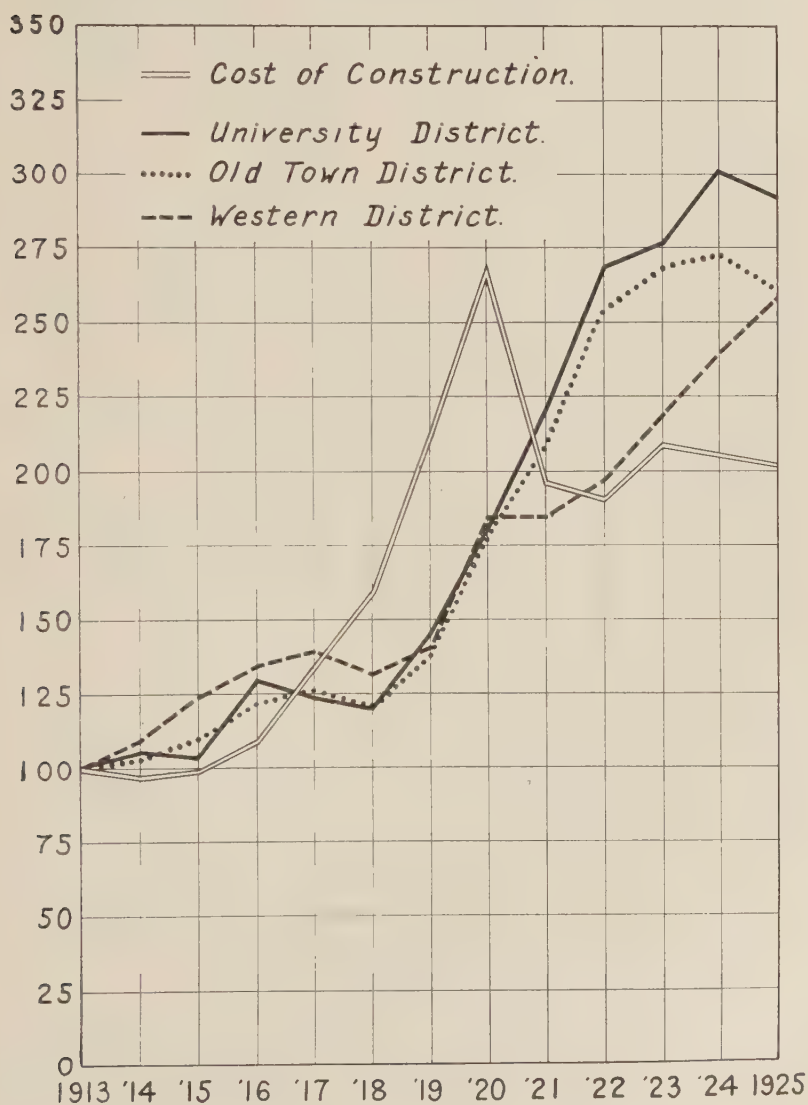


TABLE XIII. THE AMERICAN APPRAISAL COMPANY FRAME CONSTRUCTION COSTS INDEX

Year	American Appraisal Company Index	Year	American Appraisal Company Index
1913	100	1919	212
1914	97	1920	269
1915	99	1921	196
1916	109	1922	190
1917	134	1923	209
1918	164	1924	205
		1925	202

In *Figure 6* the course of the cost of construction is charted. For this purpose the indexes of the cost of constructing a frame industrial building, issued by the American Appraisal Company, were chosen.⁸ These indexes are given in TABLE XIII.

It would have been preferable to use an index of cost of construction in the city of Ann Arbor, but no such index existed, and it did not seem feasible to construct one for this purpose alone.

In *Figure 6* the course of the three indexes of real estate prices is also shown. The most conspicuous contrast in the movement of the two series comes with the rapidly rising construction costs that began in 1916; real estate prices did not begin to rise until 1918, and by that

⁸Among others, the following indexes of construction costs are issued periodically. Engineering-News Record index, published by the *Engineering-News Record* based upon cost of steel, cement, lumber, and the current rates paid to common labor in the steel industry; American Appraisal Company index, based upon material and labor costs in various cities (for explanation of the method used in constructing the index used here, see *American Appraisal News*, January, 1925, p. 9); the building materials group of the Bureau of Labor Statistics' All Commodity Wholesale Price Index, based upon prices of materials only; Department of Commerce, index of costs of materials entering into six-room frame and six-room brick houses, available only since 1922, and not including costs of labor; the Tuttle Index (formerly the Aberthaw Index) of cost of constructing industrial building, based on 1914 as the base year.

A comparison of all of these indexes led to the conclusion that the American Appraisal Company's index of the cost of constructing a frame industrial building was probably best adapted to the present purposes. It may be stated that all of them are in substantial agreement over the period covered by this study. Strangely no index of the cost of constructing single-family dwellings seems to exist, even for localities.

time a considerable gap had come between the two. By 1920 construction costs had reached their peak; but real estate prices, maintaining a lag, continued an uninterrupted swing upward until 1922; and by that time they had attained such a momentum, apparently, that the general upward movement continued for two years longer.

It is somewhat difficult to account for this discrepancy, except on the ground of general lack of information regarding the actual situation so far as the cost of construction was concerned. It is probably true that the general public, (or at least that part of it which constitutes the market for real estate in Ann Arbor), were unaware of the tremendous changes that had taken place in the cost of construction until after the peak had been passed; and when they became aware of it, they were reluctant to build, thus maintaining an abnormally high level of prices for properties that were already constructed.

It must be remembered when these two indexes are compared, that the influence of construction costs is felt almost solely on the structure being reflected but little if at all in the value of the land. The result of any effort to apply the index of construction costs directly to the index of real estate prices, as a correcting factor, is invalid; it gives a false emphasis to the cost factor. The results would minimize the fluctuations in land values so long as the index of cost of construction is higher than 100, and exaggerate them when that index is lower.

It is to be hoped that in the future a study can be made that will determine whether the course vacant or unbuilt property prices pursued was the same or similar to that taken by residence property as a whole. This may be accomplished by a study of prices placed on vacant lots, when they are listed, by some such method as the one here described, or by (what would probably be preferable) a direct study of actual selling prices supplied by those who are engaged in the business of negotiating real estate transactions.

CONCLUSION

The purpose of this study was to find a method of collecting and analyzing data on real estate price movements that would make possible the construction of an index of real estate prices. The results of the application of the process to at least one community are given. On the whole, these results coincide with the judgment of real estate dealers

and observers in the particular locality concerned. It seems, therefore, that the method is sound and can be relied upon to yield results that are dependable. It seems that the method is one which can be widely used to considerable advantage in various localities to build up an index of real estate prices. In view of the paucity of material on this vitally important aspect of our economic structure, the construction of such series would be well worth while.

